# (tr)uSDX QRP Transceiver Build

I was introduced to the concept of this five-band QRP transceiver by **Frank Romeo N3PUU**, a fellow member of the Gloucester County Amateur Radio Club (GCARC), a local club in southern New Jersey. When he first described the radio to me, I was intrigued by the design idea, and decided that I would have to investigate it. I went online and did some reading, then I watched a couple of videos, and I was hooked.


*Figure 1 - Promotional photo of (tr)uSDX (Courtesy of dl2man.de)*

This is a compact little transceiver (Figure 1), measuring a mere 90mm x 60mm x 30mm, and weighing in at about 140 grams. For those of us who are not metric-centric, that works out to 3.54” x 2.36” x 1.18” and about 5 ounces in weight, truly a pocket-sized transceiver. Of course, these dimensions are exclusive of the battery pack, representing only the basic radio.

In its standard configuration, the radio is a true QRP five-band multi-mode unit, boasting an 80-meter, 60-meter, 40-meter, 30-meter and 20-meter band lineup, with CW, USB, LSB, AM and FM mode capability. Alternate band lineups are available, though it is recognized that the radio is not as efficient on either of its alternative band sets. One of these alternative lineups includes 20m, 17m, 15m, 12m, and 10m while the other lineup offers 80m, 40m, 20m, 15m, and 10m.

The (tr)uSDX transceiver uses a high-efficiency power amplifier of a Class E design, reaching just about 85% efficiency when properly assembled and adjusted, at which point it will draw approximately 80mA in RX and about 500mA in TX to produce an output power of 5 watts, all from a 13.8VDC supply. The TX output power drops to 500mW when a 5VDC supply is used instead of the usual 13.8VDC supply.


*Figure 2 - Main board foil side*

The radio’s display unit is a 128 x 64 pixel alphanumerosymbologic OLED panel having a viewing width of 0.96”. This panel requires some modification from its factory configuration in order to be used in the radio. We will discuss this some more later on in this article. In addition to its onboard microphone, speaker, and push-to-talk switch, the (tr)uSDX has a Micro-USB port and provides a native CAT programming interface.

It occurred to me that it has been a while since I penned a build article, so I decided that I would write one about the build of this unique QRP transceiver, namely the (tr)uSDX device. This transceiver is a story of fives – five bands, five watts, and five modes of operation. To clarify that somewhat… the radio will produce at least five watts PEP when supplied with 13.8VDC power supply voltage and adequate current, it will operate (in its basic or native design) on 80m, 60m, 40, 30m, and 20m, and it will operate in CW, USB, LSB, AM and FM modes. See… five by five by five! This transceiver, as mentioned, features a highly efficient (≈85% efficiency) Class E power amplifier, comprised of three BS-170 MOSFET's.

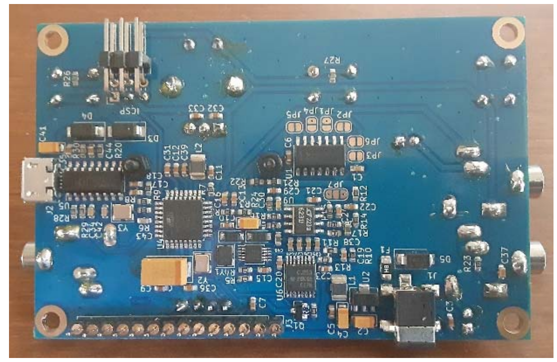

*Figure 3 - Main board component side*

The transceiver is compact, coming in at 90mm x 60mm x 30mm and 140 grams, exclusive of any battery holder that might be purchased and attached. I did in fact purchase one of the two battery holders offered on the DL2MAN website (https://dl2man.de) – more about that later. The antenna connector is a standard SMA connector, to which I installed an SMA to BNC adapter. The basic radio kit does not include an enclosure, but an enclosure kit is offered at the DL2MAN website as well. Several colors are available; I ordered the "army green" because that was the only color that was in stock and ready to ship for both the enclosure and the battery holder that I wanted.

Output power is, obviously, a function of the input power supply, with ≈0.5W anticipated on a 5VDC supply and ≈5W on a 13.8VDC supply, with the basic current draw being 500mA on TX with a 13.8VDC supply, and 80mA on RX. These values are published for the MS5351 version of the Programmable Clock Generator chip, with the note that these values are "less" for the Si5351 alternative chip. As it turns out, my kit has the Si5351 chip from Skyworks Solutions, judging by the chip markings. There is no way to know which chip you will get when you order one of these kits, as it most likely depends upon what parts are available when the boards are being made up.

So, let's talk about that for a minute. The kit includes two boards, identified as the "main board" and the "RF board". All surface mount components were pre-installed in the kit that I received, though there was a note in the build instructions about one of the SMT IC's – a 74ACT00 – possibly needing to be installed by the kit builder due to a supply issue at JLCPCB, the board manufacturer. A note is due here about JLCPCB. As a PCB manufacturing house, this firm does excellent work with great turnaround time and pricing. I use them for all of my own PCB manufacturing needs, and I highly recommend them to anyone who is looking to have boards made.

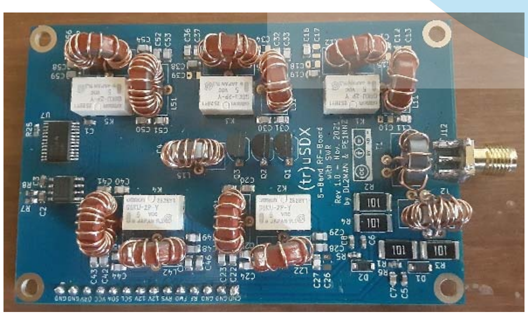

*Figure 4 - RF board component side*

While the build of this kit does include the winding of about a dozen toroidal coils, this should *not* be a deal breaker for anyone, as the toroids are extremely easy to wind. Most of them are standard coils with turns counts going as high as the twenties, but a couple of them are transformers with dual windings. However, one of these transformers has a single turn as the primary winding – that is nothing more than a wire passing through the center of the toroid. Thirteen toroids in all need to be wound, but only two of them are transformers, one with a 7:1 turns count and the second with a 21:3 turns count. For the remaining eleven toroids, turns counts range from seven turns up to twenty-two turns, all easily wound in just a few minutes. As I said, the winding of the toroids should not be a deal breaker at all.

I started the build with the main board. This meant installing, in no particular order other than shortest to tallest (as usual), the three phone jacks, the three tactile switches, the inter-board pin header strip, the ISP header, and the microphone. The inter-board pin header strip and the ISP header mount to the underside (component side) of the main board, while all of the other components mentioned are installed to the upper (foil) side of the PCB. I did not mention the OLED display or the speaker, for good reason.

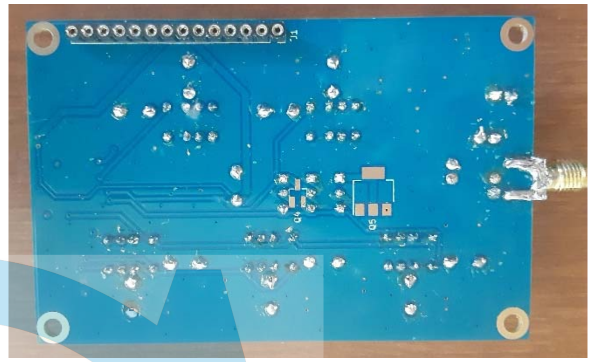

Figure 5 - RF board foil side

The OLED requires some modification before it can be installed. Specifically, two capacitors need to be removed (C3 and C4 on the OLED PCB), and a jumper wire must be installed from the "top" (collector) of transistor U2 to the "bottom" of capacitor C6. Top and bottom, in this case, are referenced with the OLED board held with the component side up and the Kapton cable towards you, putting the transistor U2 away from you and nearer the connector pin header holes. A short length of AWG 24 hook-up wire will suffice for the jumper if the wire is not included in the kit; my kit had the wire included.

After the modification of the OLED board has been performed, the four-pin header is soldered to the OLED PCB with the shorter end of the header pins going through the OLED PCB. The OLED PCB is then positioned on the main board and the provided spacer tubes are set in place under the OLED board. The provided hardware is then used to secure the OLED PCB to the main board, positioning the OLED board so that it is straight with reference to the upper edge of the main PCB. The OLED header pins can then be soldered to the main PCB.

I should take a minute here to talk about a problem that I had with the OLED board in my kit. On first power-up, the OLED in my transceiver failed to illuminate at all. Troubleshooting and repair of this issue required me to remove the OLED from the main board. The OLED board has a set of four solder jumpers in the upper right-hand corner of its underside, labeled J1, J2, J3, and J4. Some research led me to the fact that the jumpers were not configured as they should have been. Two of these jumpers, J2 and J3, should be closed in order for the OLED to power up properly. I tracked my problem down to jumper J2 being open rather than being shorted. Jumper J3 was shorted as it should have been, and jumpers J1 and J4 were open as they should have been. Applying a touch of solder to jumper J2 solved the problem for me. Make sure that you double-check these jumpers before installing the OLED to avoid having to remove it to repair the board. The funny thing is that I spent a few minutes re-doing the jumper wire installed between U2 and C6, as I wrongly assumed that the problem was due to something that I had done.

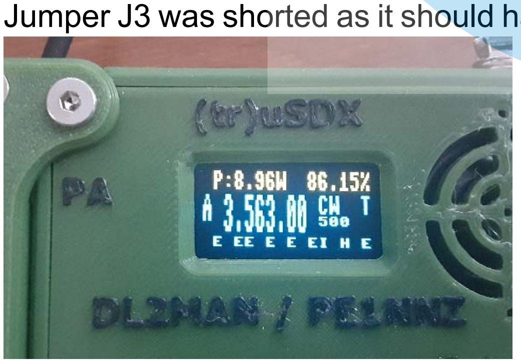


Figure 6 - Power and efficiency displayed

Installation of the speaker requires the use of the adapter ring that is included in the enclosure kit (more about the enclosure kit later). The ring is placed on the speaker with the two pins on the ring periphery facing upwards, or in the same plane as the face of the speaker cone. The two (provided in my kit) speaker wires get soldered to the speaker pads, and then oriented in the notches provided in the underside of the adapter ring, and then are routed to the two speaker connections on the main board. Be sure to observe speaker polarity here.

Once the OLED and the speaker are installed, the main board is complete and ready for use (Figure 2 and Figure 3). Next up is to build up the RF board. This process involves installing five relays, installing the SMA antenna connector, winding and installing the thirteen toroids already mentioned, installing the inter-board pin socket header, and finally installing the three BS-170 PA transistors.

The relays included in your kit may be SMT devices, though mine were not. If your kit includes SMT relays, simply bend each relay terminal lead downward so that it projects downward form the body of the relay. Each of these terminal leads will then fit into the holes provided in the PCB at the relay locations and can be soldered from the foil side of the PCB. Of course, if your kit includes through-hole relays as mine did, it is simply a matter of inserting them into the PCB and soldering them in place, flush to the board.

Positioning the SMA jack on the RF board is almost self-explanatory. The PCB has three pads on one surface and two pads on the opposite surface. The SMA jack is equipped with four posts that are common to the connector body, and a fifth post which is common to the center pin of the jack. Place the jack on the edge of the PCB so that the two body posts and the center post align with the three pads on the PCB surface. This will automatically align the opposite two body posts with the two pads on the underside of the PCB. Be sure to align the jack on center to the pads so that it will fit properly into the enclosure later.

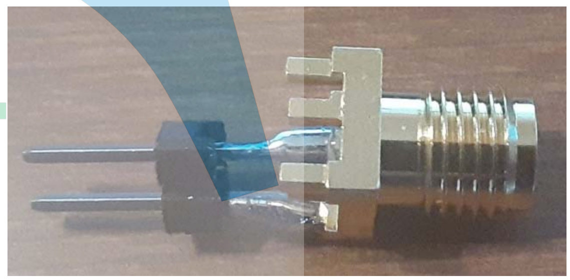

*Figure 7 - RF connector adapter for NanoVNA*

Now let's get down to the part that most folks hate and therefore avoid buying kits like this one – winding the toroids. As mentioned earlier, there are a total of thirteen toroids to be wound, two of which are transformers. There are two different toroid cores supplied in the kit, ten of one type (T37-2) and three of another (FT37-43). The T37-2 cores get wound as 7 turns (one), 8 turns (one), 10 turns (two), 12 turns (two), 14 turns (one), 15 turns (one), 17 turns (one), and 19 turns (one). The FT37-43 coil is wound as 22 turns. The two transformers, also wound on FT37-43 cores, are wound as 7 turns / 1 turn and 21 turns / 3 turns. Note that the original instructions called for both of these transformers to be wound as 7:1 turns count transformers. Though the turns ratio remains the same at 7:1, transformer T2 is now wound at the 21:3 turns count. The reason for the transformer change is overall efficiency. In a move to validate the efficiency of the radio, thermal imaging of the working device was done, and it showed some heat losses in the vicinity of SWR transformer T2. The other SWR transformer, T1 was fine, but something needed to be done about T2. The designers toyed with the ideas of changing the turns ratio and modifying the firmware to match, but that idea was nixed because of software and memory limitations. Experimentation, however, showed that increasing the inductance of T2 while maintaining the same turns ratio would achieve the desired results without requiring any firmware changes. The change made was to take T2 from a 7:1 turns count to the current 21:3 turns count, which maintains the turns ratio while providing the requisite increase in inductance.

When winding the toroids, remember to strip the enamel from the wire right up to the body of the core, so that when the wire gets pulled tightly into the PCB, stripped wire will still be available for proper soldering.  The enamel can be stripped either by scraping with the edge of a knife blade or by cleaning it off with some fine (400-grit) emery cloth or sandpaper.  The magnet wire provided in my kit did not take well to being heat-stripped; I had to mechanically remove the enamel insulation from the wire.

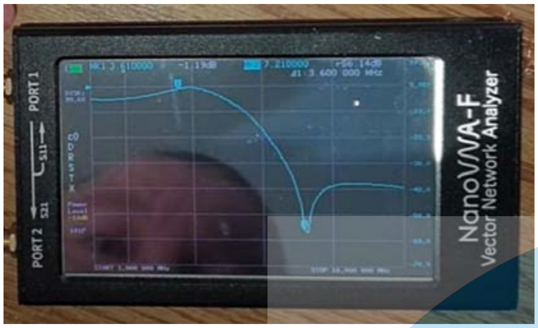


*Figure 8 - 80-meter waveform showing dip*

The two transformers are best wound as single coils which are then installed to the PCB, that coil with the greater (either seven or twenty-one) turns count being the secondary winding.  Once the toroid is soldered in place, the primary winding can be installed into the stationary toroid quite easily.  In fact, in the case of T1, it is just a matter of stripping the ends of a length of wire, and then passing the wire through the center of the toroid.  The single wire passing through the center of the core constitutes a single winding, even nothing is "wound".  The T2 primary winding is installed in the same manner, with the exception that a longer length of wire is needed, and that it is passed three times through the center of the core.  Again, take care with the stripping so that bare wire is in the right place for soldering.

The inter-board pin socket header is to be installed to the foil side of the PCB and gets soldered on the component side of the board.  Make sure that the header is flush to the board when installing it.  It will later align with and mate to the pin header on the main board when the radio is assembled.

The choice of transistors for the power amplifier in this unit is very astute, as these devices are readily available at low cost and are easily replaced if they should fail.  The BS-170 is an internally diode-protected N-channel enhancement mode small signal MOSFET in a plastic TO-92P case.  Because they are MOSFET's, special care should be taken against static electricity damage to the transistors during handling and installation.   In addition, soldering heat time should be limited to prevent thermal damage to the transistors.  Get in there, get the job done, and get out as quickly as is possible.  When installing the three transistors, I recommend soldering one lead of each device at a time, moving to the next transistor each time, rather than simply soldering all three leads of a given device sequentially.  This gives a little bit of cooling time between applications of heat to each device.  Of course, a hemostat can be clipped on to each lead prior to soldering that lead so as to provide some soldering heat sink protection.  Just be careful not to damage the transistor leads when doing so.

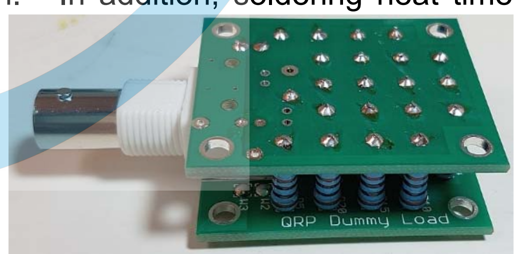


*Figure 9 - QRP Labs dummy load*

It is the use of the BS-170 transistors, which are quite robust, that makes this design so efficient, together with the manner in which these transistors are implemented.  The truth of the matter is that this radio will output considerably more than the nominal five watts if the power supply voltage is increased, though there is a practical limit beyond which we begin to get into the region of diminished returns, at which point the PA's will begin to overheat and then to fail. Some user experimentation has shown that input voltages as high as 16VDC are acceptable, with resultant output power approaching ten watts. This is not within the claimed performance range of the radio, but none the less it has been documented.

*Figure 10 - Latching relay used*

Once the PA transistors are installed, the RF board is complete and ready for installation (Figure 4 and Figure 5). The two boards will marry easily by aligning the pin header on the main board with the pin socket header on the RF board, and then simply pressing them together. At that point, the radio is ready for testing and use.

Each relay on the RF board has a pair of toroidal chokes associated with it, one of which has a "1" number and the other of which has a "2" number, *e.g.,* L11 and L12 or L31 and L32. The "1" choke is the series resonance choke and controls the bandpass, while the "2" choke is the pi choke and controls, among other things, the second harmonic notch in the band response. For each of these coils, spreading the turns apart decreases the inductance while moving the coils closer together increases the coil's inductance. The chokes, and thus their associated relays, are so numbered that K1 (L11 & L12) is for 20 meters, K2 (L21 & L22) is for 30 meters, K3 (L31 and L32) is for 40 meters, K4 (L41 & L42) is for 60 meters, and K5 (L51 & L52) is for 80 meters.

The power and efficiency of each band can be read directly from the OLED display (Figure 6) while the radio is operating in CW TX mode, and each band's frequency response can easily be displayed on a NanoVNA set to sweep the proper frequency range. Be sure to include at least the band's center frequency and its second harmonic when setting the NanoVNA stimulus range.

Before I begin the tweaking process, I want to say a few words about the enclosure kit that is available from the DL2MAN website. The enclosure kit includes six major pieces – a top panel, a bottom panel, two end panels, and two long panels for the front and back. We will discuss the enclosure kit again in a little while, but for now, I want the reader to understand the wisdom of using the long front panel as a board spacer when working on the radio with power applied and the enclosure removed. This provides the requisite spacing between the boards to prevent any inadvertent short-circuits from occurring. The inter-board pin header connection performs the same function along the opposite edge of the board pair. This is an important point to remember, as pressing the tactile switch buttons on the main board, which is done during testing, can be enough to cause shorts between the boards without proper board spacing.

Once the front panel strip is in place between the boards, begin by checking and recording, for each band, the reported output power and efficiency from the (tr)uSDX OLED display. This should be done at a fixed input voltage of at least 12VDC but not more than 13.8VDC. These will be the basis readings for any adjustments to be made. Out of the box, so to speak, mine performed as follows:

- 80 meters – 6.12 watts @ 87.5% efficiency;
- 60 meters – 4.21 watts @ 86.12% efficiency;

- 40 meters – 4.92 watts @ 84.89% efficiency;
- 30 meters – 5.82 watts @ 84.60% efficiency; and
- 20 meters – 4.93 watts @ 84.30% efficiency.

The above readings were all straight from the OLED display in CW mode, powered by a 13.8VDC 1A power supply. Not bad for free-hand wound toroids with no adjustments made.

Next up, I looked at the band waveforms on the NanoVNA. To do this, you will need a special adapter (Figure 7) made from a two-pin 0.100" pitch breakaway pin header and a PCB mount SMA jack. Solder the two-pin header section to the SMA jack with one pin to the center pin of the jack and the other pin to a body pin of the jack. This will be used for the S11 connection to the NanoVNA. This adapter will be connected to the RF and GND ports of the pin socket header on the RF board. When holding the RF board so that the foil side is up and the pin socket header is away from you (with the antenna jack to the right), the RF port is the fourth port from the right, and the GND port is the third port from the right. The S21 connector of the NanoVNA will be connected to the antenna jack on the RF board. The sweep signal, of course, will come directly from the NanoVNA.

Calibrate the NanoVNA for the adapter cables that will be used and store the calibration in a memory slot. You will recall that calibration for each band in turn, setting the stimulus range to the proper values for the band being swept. One by one, set the NanoVNA to the appropriate stimulus range and read the waveform displayed. You are interested in the position of the fundamental frequency and the location of the second harmonic frequency. If all is right, the second harmonic will be in a pronounced dip in the band waveform, and the fundamental frequency will be at the top of the trace. Some suggested frequencies for use in this test are as follows:

- 80m – fundamental is 3.5MHz and 2$^{nd}$ harmonic is 7MHz, sweep 1MHz to 10MHz;
- 60m – fundamental is 5.3MHz and 2$^{nd}$ harmonic is 10.6MHz, sweep 3MHz to 14MHz;
- 40m – fundamental is 7MHz and 2$^{nd}$ harmonic is 14MHz, sweep 4MHz to 18MHz;
- 30m – fundamental is 10MHz and 2$^{nd}$ harmonic is 20MHz, sweep 5MHz to 25MHz; and
- 20m – fundamental is 14MHz and 2$^{nd}$ harmonic is 28MHz, sweep 10MHz to 30MHz.

Use a second marker on each trace to locate the two frequencies of interest – the fundamental (Marker 1) and the second harmonic (Marker 2). If the second harmonic is not in a pronounced dip in the trace, adjust the "2" choke turns as required to bring the harmonic into the dip (Figure 8). If the band waveform is not wide enough to keep the fundamental at the peak of the waveform, adjust the turns of the "1" choke to get it there.

The NanoVNA testing is easily done, but any power-on TX testing requires the use of a dummy load. Any QRP dummy load of fifteen- or twenty-watts capability will suffice. QRP Labs (https://qrp-labs.com) makes an ideal little kit for $8.50 plus shipping, a compact twenty-watt unit with an attached BNC connector (Figure 9) that will attach directly to the (tr)uSDX radio if an SMA to BNC adapter is installed.

A couple of points to remember when making these tests and adjustments…. first is the fact that the relays used on the RF board are of the latching type (Figure 10). This means that each time a pulse is applied to the relay coil, the points change position from one state to the opposite.

These relays are DPDT types, meaning that the relay will switch from its NO and COM pairing to the NC and COM pairing, and *vice-versa*, each time a pulse is applied to the relay coil. What this means for us is that the RF board will remain in the status it was in when it was powered down, based upon the last band selected for operation. Thus, if we want to service a specific band's coils, we must assemble the radio, power it up, and select the band whose coil(s) we intend to service. When making the band waveform tests with the NanoVNA, we must therefore assemble and disassemble the radio each time we want to switch the test and repair from one band to another.

*Figure 11 - Menu item 8.3*

Second, in order to assure the lowest possible harmonic output from the radio, it is imperative that each band be checked to ensure that its second harmonic frequency falls cleanly into the filter notch. Adjustment of the "2" choke, and possibly even the addition or removal of a turn or two on the core, may be necessary to achieve proper filtering of the output frequencies. Because of the fact that all components used in the construction of the radio have inherent design tolerances, it may turn out that adjustment of the chokes will be required. For example, I had to remove two turns from the 80-meter pi choke L52 in order to get the second harmonic of 7MHz into the notch (refer back to Figure 8). (Do not be dissuaded by this; it is part and parcel of radio design and construction and is well within the skill set of any reasonably experienced or knowledgeable ham operator.

Another pre-use task that must be performed is to validate (or calibrate) the frequency indications on the OLED display for each band. This can generally be done quite simply through the use of a dummy load and another HF receiver, and correction needs to be made, usually, on only one band, usually the 20-meter band. Start out by setting up the (tr)uSDX for CW operation at a given frequency in the 20-meter band, say 14.060MHz. Tune the second receiver to the same mode and frequency. Then transmit into the dummy load and watch for the received signal indication on the second receiver. What we are shooting for here is a zero-beat condition, with the (tr)uSDX output frequency matching the VFO frequency of the commercial receiver. If a zero beat is attained right off, great! The displayed frequency is accurate. More likely, however, there will be a difference between the two radios' frequencies. To correct this, enter the (tr)uSDX menu system and navigate to menu item ***8.3 – Reference Frequency*** (Figure 11). This setting will be varied to bring the (tr)uSDX into line with the commercial receiver. Adjust the Reference Frequency as required to achieve the zero-beat condition, and lock it in there. That is all that there is to it.

There are several good YouTube videos online regarding the tuning and tweaking processes for the (tr)uSDX, many of them produced by DL2MAN himself. Watch these videos before beginning the process; it will make the job that much easier. I found the videos to be mostly helpful, and DL2MAN has an easy-going way about explaining things that makes them easy to understand.


*Figure 12 - Enclosure panels*

Once the tuning and tweaking tasks are completed, it is time to complete the final assembly of the radio. The optional enclosure, which I highly recommend, is a six-piece 3-D printed affair (Figure 12) with a few extra parts and pieces. One of the extra pieces is the 3-D printed spacer ring for the speaker, which has already been discussed. Another is a 3-D printed knob for the rotary encoder. Of course, the enclosure kit includes the necessary hardware for assembly.

The enclosure is assembled by first placing the long front and rear panels onto the married printed circuit boards, taking care to align the power jack with its opening in the rear panel. It should be noted that there is a thinned area that aligns with the ISP header on the main board. This thinned area can be cut out to make the ISP header accessible with the enclosure assembled, or it can be left intact if so desired. I left mine intact, as it is easy enough to disassemble the enclosure to update programming if that should become necessary.


*Figure 13 - All side panels installed*

After the front and rear [panels are installed to the board sandwich, the two end panels can be installed, again taking care to properly align the various openings in the panels with their mating jacks (Figure 13). Next, place the bottom panel onto the assembly, followed by the top panel. When installing the top panel, be careful to align the detent pins on the speaker spacer ring with the mating holes in the top panel so as to properly position and secure the speaker. Now install the screws that hold it all together, taking care not to overtighten these screws. Finally, install the washer and hex nut on the rotary encoder, followed by the 3-D printed encoder knob. That's it! The radio is now complete (Figure 14)… but hang on for the battery enclosure.


*Figure 14 - All panels installed*

There are two different battery holders offered on the DL2MAN website, and I chose the second of these. One of these holders mounts to the radio underneath the bottom of the radio, using a replacement bottom panel with a dovetail slide arrangement for securing the battery holder to the radio. The second battery holder, which is the one that I selected, mounts to one end of the radio, making it longer but maintaining its original height and width. That holder mounts to the radio with tabs that align with the existing screws that hold the radio together.

Assembly of the battery holder is self-explanatory but for one small detail… the USB pass-through connectors that are included. Because this battery holder mounts to radio on the end where the USB connector comes through the enclosure panel, provision is made to carry the

USB connection out to the side of the battery holder.  This USB pass-through consists of two connectors and four wires that need to be soldered between the two connectors, forming a male/female extender that plugs into the original USB port on the radio and carried through to its mounted position in the side of the battery holder.

The battery holder will hold four “AA” sized cells.  I chose to use 14505 non-rechargeable lithium cells that produce 3.6 volts each.  The battery box holds three of these cells, which total out as 10.8VDC due to the fact that the cells are wired in a series string in their holder.  While this is adequate for most RX and for very low power TX, I prefer to use the 13.8VDC 1A power supply for most use of the radio.

When assembled, the battery box, as already mentioned, mounts to what would be the right side of the radio (Figure 15).  The USB carry-through, once assembled, is plugged into the radio USB ports and then gets positioned on its mounting pins in the recess provided for it in the battery compartment.  Finally, the “AA” x 3 battery tray leads get spliced to the radio power cord provided.  Once that is done, simply load the cells into the battery tray and slide the tray into the battery box.  It is a tight fit and you need to be careful of the wire leads, but it goes together fairly well.  The last step is to slide the battery tray cover into place in the tracks provided in the battery box.  To power up the radio, simply plug in the power cord to the power jack on the back panel of the radio.  Secure the battery box to the radio using the extra-long screws provided, and the job is done.  The cells can be changed later by simply sliding open the battery box lid and pulling the battery tray out of the box.  Reverse the process to re-assemble the unit with the new cells in the tray.

*Figure 15 - Battery box installed*

OK – we have talked all about this little marvel, but we have not discussed the important things… how much it costs, how long it takes to arrive, and how long the assembly process takes.  I can safely say, in response to the last point first, that it takes longer to tune, tweak, and calibrates the unit than it takes to build it.  The build took me about forty minutes (including the time to correct the OLED jumper issue).  The after-build work took me a couple of hours, partly due to having to remove and modify some of the toroids.

Let’s talk about cost and lead time.  When I ordered my kits, the price for the radio kit was ≈$86.00, the enclosure kit was ≈$19.00, and the battery box kit was ≈$25.00.  With shipping costs thrown in, the total came to ≈$140.00.  Very reasonable, in my book.  As to the lead time, I had my kit within a week of the date that I placed the order.

The DL2MAN website offers several purchase options as regards vendors.  I opted to stay in-house and purchase from the vendor directly associated with DL2MAN, which was https://newdiytech.com, a site flagged as “the official sales outlet” for the (tr)uSDX by its creators. I was not sorry that I did so.

The DL2MAN website has an excellent forum for builders of these radios.  A recent live video chat with Manuel and Guido, the forces behind the (tr)uSDX, revealed that there were some fifteen thousand of these radio kits out there in the wild at that point. This has become a tremendously popular QRP radio with very few weak points.

Naturally, nothing is perfect, and this radio is no exception. While they did the best that they could in sourcing a speaker for this radio, the one that they chose, quite frankly, is well below par in terms of audible and recognizable sounds coming from it. As time allows, I will find a better alternative that I can fit into place in there – if one exists. In the meantime, an external speaker or a headset is your best answer to the problem.

I did not have to load any firmware or programming into my radio, as I pre-ordered the chip to be coded with my call sign, a service that is provided at no additional charge when you ask for it as you make the purchase. No clear means is provided for doing the "asking", so I simply sent an e-mail to the support folks with my request, and it was answered in the affirmative almost immediately.

The burning question… "Does it work?"… was answered for me one afternoon at the GCARC Clubhouse while waiting for my scheduled class to start. Sitting there in the Clubhouse and fooling around with the radio, I made a phone QSO with a gentleman in Pensacola, Florida. This contact was made on 20 meters using, believe it or not, a long telescopic wand antenna mounted to the BNC adapter on the radio's antenna jack. Nine hundred and thirty-two miles as the crow flies on 3.87 watts. The power was down slightly due to the use of the battery pack instead of the power supply. He said it was weak and noisy, but he could pull my signal out. I was quite impressed at the time, and more impressed now that I have had some time to think about it.

All in all, I give this kit and the resultant radio high marks for design and implementation. The unit lives up to its advance billing and all adjustments are easily made using common equipment found in most ham shacks. I am happy with the finished product, though I would have liked to have seen four cells in the battery holder. Four 3.6V cells would give me 14.4 volts, a better fit than the current 10.8V achievable with three 3.6V cells. Even the battery holder designed by DL2MAN only holds three cells, though his holder does accommodate 18650 cells instead of 14500 cells. The 18650 cell is nominally a 3.6V cell, though some manufacturers label it as being 3.7V instead. Either way, we are still left with less than 12VDC to power the radio, either 10.8V at 3.6V per cell or 11.1V with 3.7V per cell. I would have liked to see both designers incorporate a four-cell solution, and I may just work on one of my own design in the not-too-distant future.

Please feel free to send me any comments or questions regarding this build and/or this article. I can be reached via email at *chris@ad2cs.com*, and all emails will be answered.